



# Ground Water Protection in Virginia

2001 Annual Report of the Ground Water Protection Steering Committee

## 2000 Ground Water Festival - Virginia Naturally 2000

Virginia's first state-sponsored Ground Water Festival was held September 22 at Massanetta Springs Conference Center and was a tremendous success. DEQ staff worked with Bill Sprinkel, the Rockingham County Schools General Supervisor, to incorporate sessions that would assist sixth grade teachers with Standard of Learning 6.11: Natural Resource Management. Teachers attended an August workshop where they received instruction on land use management, karst protection, and other general ground water protection concepts. The teachers attending the workshop also received a box of resource materials to assist with pre- and post- festival activi-

ties. Three hundred eighty three sixth grade students from Elkton and Hillyard Middle Schools attended the Festival. Dennis Treacy, DEQ Director, and Bill O'Brien, Rockingham County Administrator, greeted the attendees. The students then rotated through six of eight available sessions and were treated to lunch in the dining hall at Massanetta Springs Conference Center.

The sessions highlighted ground water's role in the water cycle, the formation of springs and sinkholes in karst land, the use of Geographic Information Systems in land use management, runoff and management of nonpoint source pollution, and water quality and conser-

vation. Forty seven volunteers from numerous Federal, State, and local agencies and committees assisted with all phases of the event from leading educational session to escorting the classes around the grounds.

The event was funded through a Department of Environmental Quality (DEQ) Ground Water Protection Grant from the Environmental Protection Agency (EPA) and a grant from National Project W.E.T. and the Perrier Group. Many thanks to our partners from the Department of Conservation and Recreation, the Department of Health, the Department of Agriculture and Con-

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## PERSPECTIVE

### *The Year in Review*

The 2000-2001 year was a busy one for Steering Committee members and their agencies. Steering Committee meetings saw reports concerning Virginia's source water assessment program, sinkhole remediation, development of new wetland regulations, initiation of new regulations for water reuse (primarily with the land application of reclaimed wastewater), potential changes to water quality standards based on primary contact and secondary use, new surface water management areas, and other ground water activities.

Long-time member Sara Pugh, of the Department of Agriculture and Consumer Services, left state government for other work. And two long-time contributors to Steering Committee activities, Terri Brown of the Department of Conservation and Recreation, and Ken Coffman of the Virginia Rural Water Association, announced plans that will

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# ACTIVITIES AND SERVICES

## *Rural Household Water Quality Education Program*

To improve the quality of life of rural household residents, as well as the general environment, Virginia Cooperative Extension's Rural Household Water Quality Education Program was begun in 1989. To date, more than 10,000 households in 74 counties (see Table 1) have participated in this program by collecting samples from their private, individual household water supplies and having them tested at Virginia Tech laboratories for a minimal fee. Testing consists of 1) a general water chemistry analysis for iron, manganese, hardness, sulfate, chloride, fluoride, total dissolved solids, pH, saturation index, copper, sodium and nitrate; and 2) microbiological testing for total coliform and *E. coli* bacteria.

Additional information is collected about each sample, such as the type of water source, water source environs, proximity to contaminant sources, and treatment devices installed. All water quality test results, along with pertinent water supply characteristics, are entered into a computer database, to be used for further analysis, mapping, and county and regional planning. Summary reports are available for all the counties listed in Table 1 with the exception of the last three conducted early in 2001 (Greensville, Surry, and Sussex).

The most widespread problem identified across Virginia is microbiological contamination. Through the end of 1999, 65 county programs had been conducted and test results are available from approximately 9700 household water samples. Analysis of this data reveals some interesting trends with regard to private household water sources and bacterial contamination. For example, the type of water source appears to influence the likelihood of positive bacteria results. Ultimately, "present" total coliform and *E. coli* bacteria results have been determined for 40.3% and 8.8%, respectively, of the wells and 82.4% and

42.6%, respectively, of the springs.

Furthermore, the type of well also appears to have an impact on bacteriological contamination. Wells are grouped into the categories of shallow, "dug/bored" wells, and the generally deeper, "drilled" wells. For total coliform bacteria, 68.8% of the former and 33.6% of the latter have had positive test results. For *E. coli* bacteria, positive results have been determined for 15.1% of the dug/bored wells and 7.2% of the drilled wells.

As well technology has developed and construction practices have changed over the years, the age of a well is expected to be an inherent factor impacting the above trends. In general, dug/bored wells as a group tend to be older than drilled wells. To examine this influence further, all wells were placed into one of three age categories: (1) less than 10 years old, (2) 10 to 30 years old, and (3) more than 30 years old. Positive total coliform bacteria resulted for the following percentages of wells in each of the three categories: (1) 32.3%, (2)

48.4%, and (3) 55.0%. A similar trend was noted with respect to *E. coli* bacteria being detected: (1) 2.3%, (2) 6.2%, and (3) 12.3%.

The likelihood of microbiological contamination of household water sources in Virginia also varies by region. The water quality data partitioned among the five physiographic provinces of the state are summarized in Table 2. It should be noted that disinfection water treatment devices such as automatic chlorinators and ultraviolet light systems impact a small number of household water systems and were not factored out for the purpose of this analysis.

For both total coliform and *E. coli* bacteria, differences were noted in the percentages for a given water source type across physiographic provinces. While the large number of "high-risk" springs used as household water supplies in the westernmost provinces was expected to skew the overall results somewhat, similar trends were noted upon examining the data for wells alone, both

**Table 1. Virginia counties participating in the Rural Household Water Quality Education Program, 1989-2001**

Accomack	Cumberland	Lancaster	Pulaski
Albermarle	Culpeper	Lee	Rappahanock
Amelia	Dickenson	Loudon	Richmond
Amherst	Dinwiddie	Louisa	Rockbridge
Appomattox	Essex	Madison	Rockingham
Augusta	Floyd	Mathews	Russell
Bath	Fluvanna	Middlesex	Scott
Bedford	Franklin	Montgomery	Smyth
Bland	Giles	Nelson	Southampton
Botetourt	Gloucester	Northampton	Spotsylvania
Brunswick	Goochland	Northumberland	Stafford
Buchanan	Grayson	Nottoway	Surry
Buckingham	Greene	Orange	Sussex
Campbell	Greensville	Page	Tazewell
Caroline	Highland	Patrick	Warren
Carroll	Isle of Wright	Powhatan	Washington
Chesterfield	King & Queen	Prince George	Westmoreland
Clarke	King George	Prince William	Wise
	King William		Wythe

**Table 2. Percentage of household water samples with positive total coliform/E. coli bacteria**

<u>Province</u>	<u>All Sources</u>	<u>Drilled Wells</u>	<u>Dug/bored Wells</u>	<u>Springs</u>
Cumberland Plateau	59.0/14.4	50.1/6.6	80.0/35.0	97.7/52.9
Valley and Ridge	49.5/19.1	41.4/12.9	67.5/26.3	90.0/51.1
Blue Ridge	25.1/7.2	14.3/2.4	33.3/0.0	43.0/11.1
Piedmont	43.3/10.1	30.2/5.6	74.6/17.8	81.4/39.2
Coastal Plain	35.8/4.2	25.2/4.2	60.9/8.9	NA

dug/bored and drilled.

The Rural Household Water Quality Education Program is ongoing with similar countywide programs planned in Charlotte, Hanover, Henrico, Lunenburg, and Prince Edward for the latter half of 2001. For additional information, contact Blake Ross of the Department of Biological Systems Engineering, Virginia Tech at 540-231-4702.

## *Changes in the Virginia Solid Waste Management Regulations*

The Amendment 2 of the Virginia Solid Waste Management Regulations (regulations) became final on May 23, 2001. The changes in the regulations affect landfill monitoring requirements, the permitting process and corrective action procedures (ground water remediation).

The Amendment affects two primary areas for the regulated community: construction and demolition debris (CDD) and industrial landfills. Appendix 5.3 has been removed from the regulations and replaced with Appendix 5.5. Landfill facilities are now required to monitor in accordance with Appendix 5.5 after it is determined that there may be a release from the facility. Appendix 5.5 contains 62 specific constituents that are the same constituents monitored by sanitary landfills. These constituents require fewer analytical methods and are less costly because they are used by the sanitary landfills. The constituents list is equally protective of human health and the environment.

The CDD and industrial landfills in Phase II monitoring were previously required to monitor quarterly. However, the monitoring frequency is now semi-annual, which is the same as the frequency for sanitary landfills.

Amendment 1 of the Regulations required major permit amendments for the establishment of ground water protection standards, the initiation of an assess-

ment of corrective measures, and the addition of a corrective action program. Amendment 2 removed the requirement for the first two major amendments to speed up implementation of a corrective action program. Approvals will now be issued by the Department for establishment of ground water protection standards and the assessments of corrective measures without the amendment of the facility permits.

In order to expedite ground water corrective action, a facility may now implement a presumptive remedy in lieu of completing an assessment of corrective measures. A presumptive remedy is a remedy that has been proven to contain or remediate ground water contamination. The presumptive remedies are specifically listed in the Regulations and will be approved, as appropriate, by the Director. However, the facility must hold a public meeting before the assessment of corrective measures or the presumptive remedy can be approved. A presumptive remedy cannot be the sole remedy for facilities exhibiting contamination beyond the facility boundary (the permitted property boundary).

In conclusion, the changes in regulations for sanitary landfills were very slight, with the exception that certain permit amendments are no longer required. The CDD and industrial facility requirements are more consistent with the sanitary landfill requirements and

generally less burdensome. Ground water remediation should be implemented in a faster manner while remaining protective of human health and the environment.

For more information contact Howard Freeland at VDEQ (804) 698-4219.

### ***The Ground Water Protection***

#### ***Steering Committee***

meeting is held the third  
Tuesday of every other month

(January -- March -- May -- July --  
September -- November)

**All are Welcome  
to Attend**

Meetings are normally held at  
the Department of Environmental  
Quality, 629 East Main  
Street, Richmond, from 9 a.m.  
to 11:00.

For more information, contact  
Mary Ann Massie, Department  
of Environmental Quality, at  
(804) 698-4042

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## 2001 Ground Water Studies in Virginia

During 2001, the U.S. Geological Survey continues to carry out several cooperatively funded hydrologic investigations of Virginia's ground water resources. These investigations are providing relevant and reliable hydrogeologic information that will contribute toward assessing, managing and protecting the Commonwealth's ground water resources.

Among the current efforts, the statewide Virginia Aquifer Susceptibility Study, being conducted in cooperation with the Virginia Department of Health, has age-dated ground water from public water supply wells in Virginia's major aquifer systems to define its natural sensitivity to contamination from near-surface sources and to guide future sourcewater assessment activities. The project's data collection and analysis phases are complete and the results will be interpreted in a published report in the coming year.

In another project in cooperation with Frederick County, assessment of the availability of ground water in the northern Shenandoah Valley carbonate aquifer system began this past year. This work has focused on an evaluation of existing information, an inventory of wells, and development of a ground water data collection network. These data, along with seepage measurements on selected streams, will be used to calculate a water balance for the aquifer system.

Data collection also continues in the Polecat Creek watershed where, in cooperation with the Chesapeake Bay Local Assistance Department, the USGS is assessing ground water as a nutrient transport pathway to streams draining to Chesapeake Bay. This study, which included age-dating of ground water, has provided new information on nutrient transport times in ground water in shallow Piedmont and Coastal Plain aquifers.

The USGS also is completing an assessment of the Virginia Beach shallow aquifer system. New data on the

hydrogeologic framework of this complex aquifer system are currently being incorporated into a ground water model and particle-tracking techniques are being used to evaluate the potential for salt-water intrusion.

Finally, the characterization of the Chesapeake Bay Impact Crater and development of a new Coastal Plain ground water flow model began full implementation this year. This large-scale effort is being carried out in cooperation with the Virginia Department of Environmental Quality and the Hampton Roads Planning District Commission.



*The U.S. Geological Survey drill rig positioned at Bayside in Mathews County, Virginia, where a sediment core from the Chesapeake Bay impact crater is being analyzed to determine the crater's geologic history and its effects on ground water.*

Discovery of the Chesapeake Bay impact crater has profound implications for the nature and future development of heavily used ground water supplies in eastern Virginia. (See article in 2000 Annual Report "Ancient Blast from Space Leaves Lasting 'Impact' on Eastern Virginia's Ground Water.") Hydrologic analyses are being performed on sediment core obtained by drilling at the NASA Langley Research Center in Hampton, Virginia during 2000. For ex-

ample, the salinity of pore water squeezed from the core was found to increase with depth to seawater concentration. Other chemical data indicate that the salinity possibly originated from mixing of seawater with fresh ground water. In addition, a thick layer of dense clay that caps the crater-fill sediment was found to have a very low permeability, possibly impairing the ability of fresh ground water flow to flush seawater from the crater sediments. Pending analyses confirm these results and possibly provide an estimate of the age of the ground water within the crater.

Analyses similar to those performed on the NASA core are being undertaken at two additional deep test holes being drilled into the crater during 2001. Core drilling was completed in May at a site in western Mathews County, Virginia, and the drilling of a second core hole began in June in southern Mathews County. This second site (see photo) is located closer to the center of the crater than previous project core holes and likely will reveal substantial new information about the physical character and formative processes of the crater. Information generated by these investigations is being incorporated during the next several years into regionwide analyses of the Virginia Coastal Plain aquifers to provide an improved understanding of the crater's effects on regional ground water flow and quality.

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### **Ground Water Protection Steering Committee Website**

Do you want to learn more about the Steering Committee's work? Or find web sites with ground water information? Let us know what you think of the site while you're there!

<http://www.deq.state.va.us/gwpsc>

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# Mathews County School Kids Learn about the Chesapeake Bay Impact Crater

*Right In Their Own Back Yard!!!  
Virginia Naturally At Its Best!!!*

Thirty-five million years ago, a bolide struck the water in the Lower Chesapeake Bay, creating a 56 mile diameter impact crater. School children in Mathews County were given a unique opportunity to visit a scientific research station near their schools to learn more about the crater and the area's geologic history. Mr. Scott Bruce, with the Virginia Department of Environmental Quality, visited the schools in February to introduce the phenomenon of impact craters to the students and teachers. In April, the students traveled by school bus to the site and learned more about the research activities from Mr. Bruce and US Geologic Survey staff, including Dr. Jean Self-Trail, Mr. Randy McFarland and Mr. George Harlow. For more information on the Chesapeake Bay Impact Crater please visit <http://geology.er.usgs.gov/eespteam/crater/>.

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sumer Services, the Department of Mines, Minerals and Energy, the Department of Environmental Quality-Valley Regional Office, the Virginia Cooperative Extension, the Virginia Ground Water Protection Steering Committee, the US Geological Survey, the Headwaters Soil and Water Conservation District, Rocco Enterprises, Inc., the Shenandoah Pure Water 2000 Forum, Massanetta Springs Conference Center, the Virginia Rural Water Association, the Virginia Ground Water Guardian Affiliates, Harrisonburg High School, and Rockingham County Public Schools.

A Ground Water Festival is scheduled for September 2001 in Virginia's Coastal Plain. For more information, contact Mary Ann Massie at the DEQ: 804-698-4042.



*A student from Thomas Hunter Middle School examines microfossils under a microscope.*



*Mrs. Morris's class poses for a group photo with Mr. Scott Bruce in front of the drill rig.*



*Rockingham County 6th graders participate in hands on activity where sinkhole formation is demonstrated.*



*Students continue hands on activities with the EnviroScape where they look at land use impacts on ground water.*

# DEQ's Environmental Management System

In April, 2000, DEQ launched the Virginia Environmental Excellence Program, a voluntary program designed to encourage Virginia organizations to develop environmental management systems and pollution prevention plans. As part of its efforts to promote the use of environmental management systems (EMS), DEQ announced in June, 2001, that it had developed an EMS of its own. DEQ developed its EMS over a five-month period with committee representation from each Division and all Regional Offices. DEQ staff Harry Gregori, Mary Jo Leugers, and John Cunningham co-chaired the committee. Facilitation assistance was provided through an EPA grant. The DEQ EMS conforms to the requirements of ISO 14001. DEQ intends to apply for participation in the Virginia Environmental Excellence Program in the fall of 2001.

An EMS is a document or series of documents that contains a statement about an organization's environmental policy, its goals and objectives, procedures, training commitments, record keeping, communication, and its evaluation system to guide the actions of the organization. An EMS is similar to a business plan or a strategic plan with an environmental perspective.

*Documents associated with DEQ's EMS are available for review on the DEQ web page.*

*<http://www.deq.state.va.us>*

*For additional information, contact Harry Gregori: 804-698-4374.*



# Virginia's Poultry Waste Management Program

On September 19, 2000, the State Water Control Board adopted the Virginia Pollution Abatement (VPA) General Permit Regulation for Poultry Waste Management, as required by House Bill 1207 (passed by the 1999 General Assembly). The regulation became effective on December 1, 2000. The regulatory program includes provisions for adequate storage of waste, proper nutrient management and waste tracking and accounting. The program uses a general permit for poultry operations and tracking and reporting requirements for growers and litter brokers.

The regulation requires growers who own or operate farms that have 20,000 or more chickens or 11,000 or more turkeys to register with the Department of Environmental Quality (DEQ) for coverage under the General Permit for Poultry Waste Management at Confined Poultry Feeding Operations. Growers required to obtain coverage under the General Permit must complete and sign a registration statement and file it with the nearest DEQ regional office by October 1, 2001.

One of the regulation's grower requirements is completion of an operator training program offered or approved by the Department of Conservation and Recreation (DCR) within one year of filing the registration statement for general permit coverage. To date, twenty-two meetings have been held throughout the Commonwealth, and over 1,100 growers have attended these sessions.

In the training program, DEQ staff reviews the Virginia Pollution Abatement (VPA) permitting process, permit contents, grower responsibilities in the event of operational changes, and how those changes may affect the permit. They also cover inspection procedures, including acceptable monitoring parameters for soil, manure and water, and the record-keeping items needed to meet permit requirements. Virginia Cooperative Extension specialists / agents discuss the relationships between nutrient use and wa-

ter quality, the need for phosphorus-based nutrient management planning, new technologies for managing phosphorous, manure testing, manure spreader calibration, litter storage, and troubleshooting dead bird composters. DCR nutrient management specialists address nutrient management plan content, management of waste storage facilities, temporary storage, manure application equipment, timing of applications, and application rates.

The regulation is designed to protect ground water as well as surface water through the use of proper nutrient management practices. The regulation addresses both the proper land application and proper storage of poultry waste. Examples of storage requirements include:

- 1) Waste stored outside of the growing house for more than 14 days must be covered to protect it from precipitation and wind;
- 2) Storm water must not come into contact with the litter;
- 3) If no liner is used under the litter, there must be two feet of separation between the seasonal high-water table and the litter; and
- 4) If a proper liner is constructed, the two foot separation distance can be reduced to one foot between the high-water table and the bottom of the liner.

Proper cleanup of storage areas is stressed in all of the training sessions. Proper cleanup involves removing all of the litter from the ground when litter is removed from the storage site to ensure that there is no residue that will cause contamination to ground or surface water. This is especially important for storage sites without permanent roofs and floors.

In addition to proper waste storage and cleanup, the following land application buffers must be maintained by each permittee:

- ◆ 100 feet from wells or springs
- ◆ 50 feet from surface waters (25 feet if incorporated the same day)

- ◆ 50 feet from limestone rock outcrops
- ◆ 25 feet from other rock outcrops
- ◆ 10 feet from agricultural drainage ditches (5 feet if injected)

Finally, waste shall not be applied in such a manner that it would discharge into sinkholes

DEQ expects between 1100 and 1200 growing operations will be required to register for coverage under the general permit. Growers are in the process of having their Nutrient Management Plans approved by DCR. Approval must occur prior to submittal of the registration statements to DEQ. As of July 1, approximately 500 approval letters have been sent out to growers by DCR, and complete registration statements are beginning to come into the DEQ regional offices, where permits are processed and issued. DEQ has hired seven of eleven new employees needed to write permits and perform inspections of these operations and expects to hire the remaining personnel by October 2001.

If you would like view, print, or download copies of the regulation and its supporting documents, please go to <http://www.deq.state.va.us/regulations/xwaterregs.html>, and scroll down to "General Permits" where the documents can be found in pdf format. If you have any questions about this article or the poultry waste management regulation, please contact Scott Haley at the DEQ Central Office in Richmond: by mail at P.O. Box 10009, Richmond, Virginia 23240; by telephone at (804) 698-4443; or by fax at (804) 698-4032.



## *GWPS - Agency Functions*

***The Virginia Department of Agriculture and Consumer Services*** (VDACS) administers the Commonwealth's pesticide programs, which are designed to prevent ground and surface water contamination by pesticides and to promote good stewardship in relation to the use and disposal of pesticide products. VDACS is also the home of the Agricultural Stewardship Act program, which helps correct farming practices and conditions that are causing or will cause ground or surface water pollution and which promotes good stewardship of the land generally. (Web Site: <http://www.state.va.us/~vdacs/vdacs.htm>) Contact: Hunter Richardson, 804-786-3539.

***The Chesapeake Bay Local Assistance Department*** (CBLAD) addresses ground water protection in several ways. First, the Bay Act Regulations include provisions pertaining to septic system maintenance, with the goal of reducing and preventing system failures and the resulting pollution. Second, the Regulations require that all lands being actively farmed within Chesapeake Bay Preservation Areas must have a soil and water quality conservation plan approved for the land. Third, the Regulations require vegetated buffer areas 100 feet wide along all perennial streams. Fourth, CBLAD's program encourages site planning that minimizes impervious cover and conserves as much existing vegetative cover as is feasible. These practices are aimed at preventing and minimizing pollutant impacts from land development, some of which affect ground water. Finally, CBLAD is conducting a long term water quality monitoring project to determine whether the program's requirements are having their intended effect. This project includes a ground water monitoring component. (Web Site: <http://www.cblad.state.va.us>) Contact: Scott Crafton 804-371-7503.

***The Department of Conservation and Recreation*** (DCR) is committed to the protection and conservation of Virginia's ground water through implementation of strategies that are based on state ground water standards, and are addressed in the Virginia Nonpoint Source Pollution Management Program. Jody Aston is the Water Quality Improvement Act program coordinator, and serves as DCR's GWPS member. (Web Site: [http://www.state.va.us/~dcr/dcr\\_home.htm](http://www.state.va.us/~dcr/dcr_home.htm)) Contact: Jody Aston, Water Quality Improvement Act program coordinator, 804-371-8984.

***The Virginia Department of Health*** (VDH) is committed to the protection of Virginia's ground water via Code of Virginia Section 32.1 Article 2 Public Water Supplies through implementation of Virginia's Waterworks Regulations. The Code and Regulations establish authority and procedures for permitting and construction standards for ground water supplies in order to supply pure water to the citizens of the Commonwealth. (Web Site: <http://www.vdh.state.va.us>) Contact: Bob Hicks, 804-786-1750.

***The Department of Environmental Quality*** (DEQ) - Ground water programs in Virginia strive to maintain existing high water quality through adopted statutes, regulations, and policies. Advancing ground water protection efforts is the goal of many DEQ programs including ground water withdrawal permitting, ground water protection, construction assistance, tank compliance, and waste permitting. The ground water/corrective action staff within the Office of Waste Permitting reviews ground water quality data from all solid waste facilities (landfills) and all land-based hazardous waste facilities (landfills, land treatment units, waste piles, and surface impoundments). The staff ensures that the facilities are in compliance with the regulations and completes all the ground water permitting requirements for those facilities. The staff is also involved with the closures of land-based hazardous waste units for the ground water issues. (Web Site: <http://www.deq.state.va.us>) Ground Water Protection contact: Mary Ann Massie, 804-698-4042. Waste Management issues contact: Howard Freeland, 804-698-4219.

***The Department of Mines, Minerals and Energy*** (DMME) protects and conserves Virginia's ground water by providing for the safe and environmentally sound development of mineral resources by regulating the mineral extraction industry, providing geologic field investigations, and offering technical assistance on the wise use of mineral and energy resources. Four of DMME's six divisions administer programs with ground water implications: Gas and Oil addresses development of gas, oil, and geothermal resources; Mined Land Reclamation ensures reclamation of land affected by surface and underground coal mining activities; Mineral Mining ensures reclamation of lands affected by mining of nonfuel minerals; and Mineral Resources provides field investigations and information on the Commonwealth's mineral resources, including geologic mapping. Lynn Haynes, Reclamation Program Manager, serves as DMME's GWPS member. (Web Site: <http://www.mme.state.va.us>) Contact: Lynn D. Haynes, 540-523-8179.

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## Karst Groundwater Protection Program

The Virginia Department of Conservation and Recreation (DCR) supports the protection and conservation of Virginia's ground water through implementation of goals and strategies set forth in the *Virginia Nonpoint Source Pollution Management Program*. The Karst Groundwater Protection Program, managed by DCR's Division of Natural Heritage, is a major initiative aimed at accomplishing these goals.

The Karst Groundwater Protection Program operates primarily in the western region of the state where karst terrain is common. Karst is a term for the cavernous, sinkhole-prone topography that develops on top of soluble rocks such as limestone, dolomite, marble and gypsum. Subtle karst features are present in the Piedmont and Coastal Plain areas. However, the majority of western Virginia's Valley-and-Ridge region is underlain by karst bedrock, in which ground water flows relatively rapidly through fissures and cracks that have been enlarged by solution to form nearly 4,000 documented caves. Due to the natural permeability of the rocks, the number of people dependent upon ground water for drinking water supplies, and the exceptional ecological diversity found in western Virginia, the karst region deserves the focused protection and pollution prevention efforts provided by the Karst Groundwater Protection Program.

The program is funded through Clean Water Act Section 319 grants from the Environmental Protection Agency. Products delivered and under development include: source water assessment and protection workshops in cooperation with the Department of Health; brochures on Forestry BMPs on *Groundwater Protection* and *Sinkholes-Doorway to Your Drinking Water*; and fact sheets on karst resources of the Upper Tennessee River watershed; model cave and karst resource preserve designs and management prescriptions; karst field trips for nutrient management planners; draft sinkhole

classification scheme for county site reviewers and nutrient management planners; karst subsidence database with counties and SWCDs; and BMPs for storm water management in karst areas.

Other major accomplishments of the Karst Program include the addition of technical staff and a dedicated environmental educator for Project Underground (the curriculum on caves, karst and ground water for grades K-12). DCR provided essential staff support for the 2000 Ground Water Festival. Karst staff also promoted the benefits of ground water monitoring for watershed protection at a workshop for the Virginia Volunteer Monitoring Council.

The Virginia Department of Conservation and Recreation (DCR) also conducted a range of other activities during the year:

- DCR participated in a joint program with TVA, the USF&WS, and the Cave Conservancy of the Virginias to clean up a number of sinkhole dumps, and to establish a cost-share program to continue sinkhole clean-ups in the watersheds.

- The Karst Resource Inventory Team, a group of cavers who volunteer their services through DCR, continued its work in the George Washington and Jefferson National Forest, and contributed greatly to the knowledge of aquatic fauna found in Virginia caves.

- Karst Program staff are providing technical support to the State Water Commission's initial study of karst ground water protection and monitoring needs in the Shenandoah Valley and to the Virginia Association of Soil & Water Conservation Districts to develop a position paper on ground water protection issues.

On May 14-15, 2001, DCR staff organized a workshop in Middletown, Virginia, entitled *Source Water Protection in Karst: Delineation, Policy, and Management Workshop*, with assistance and sponsorship from USEPA Region III Drinking Water Branch, Lord

Fairfax SWCD, the Cave Conservancy of the Virginias, and the Virginia Groundwater Guardian Affiliates. The keynote speaker was Western Kentucky University professor, Dr. Nick Crawford. His presentation, *Karst Hydrology Basics*, provided interesting case histories that illustrated relationships between the development of karst lands and ground water supplies, subsidence, flooding and other geohazards. The lunch and afternoon sessions were an ambitious mixture of informative 15-minute talks on related topics, including state/local source water assessment and protection programs and initiatives, disaster emergency response, cave mapping techniques, volunteer sinkhole clean-ups, and community outreach.

The workshop's second day consisted of field visits to collapsed sinkholes, Crystal Caverns, sinking springs, a quarry, the stormwater management pond at a large Family Dollar distribution center, and a USGS gauging station. The field visit also included Tumbling Run, a stretch of geologic formations along State Road 601 southwest of Strasburg which contain examples of many formations of the Ordovician period. USGS geologists taped 'nametags' on the rocks along the road-cut as an identification aide!

For questions regarding the *Nonpoint Source Pollution Management Program* or to requests copies of the document contact:

Rick Hill

Dept. of Conservation and Recreation  
(804) 786-7119.

A digital copy is available at the  
DCR web site:

<http://www.dcr.state.va.us>.

For information concerning the Karst Groundwater Protection Program, contact Larry Smith with DCR's Division of Natural Heritage  
(804) 371-6205.



*Continued from Agencies page 7.*

**The U.S. Geological Survey, Water Resources Division Virginia, District** (USGS) provides the hydrologic information and understanding needed for the optimum use and management of the Commonwealth's water resources. In cooperation with local, State, and Federal agencies, hydrologic information is collected and interpreted using a wide variety of techniques, and is transferred to the water resource community through reports, maps, computerized information services, and other forms of public releases. (Virginia District's Web Site: <http://www.va.usgs.gov>; Bureau-wide Web Site <http://www.usgs.gov>.) Contact: Randy McFarland, 804-261-2641.

**Virginia Cooperative Extension** (VCE) provides educational programs on protection and use of Virginia's ground water resources. A major component of the protection program deals with protection from pollutants such as pesticides and fertilizers. Extension agents in each political jurisdiction provide testing and evaluation of ground water supplies for households in 40 rural counties. Corrective actions are recommended where supplies are found to be at risk. (Web Site: <http://www.ext.vt.edu>) Contact: Waldon Kerns, 540-231-5995.

**The Virginia Department of Business Assistance** (VDBA) is the economic development agency devoted to the growth and success of the Commonwealth's businesses, many of which rely on a sufficiency of quality ground water. As the primary point of communication and contact between Virginia's business community and state government the VDBA is uniquely positioned to provide accurate input regarding the probable impact of proposed regulations on our corporate citizens. (Web Site: <http://www.dba.state.va.us>) Contact: Dean Bailey, 804-371-8228.

**Dept. of General Services, Div. of Consolidated Laboratory Services** (DCLS) provides analytical testing services to the Commonwealth of Virginia and other states as requested through state and federal agencies. DCLS services include certification services as required through the Safe Drinking Water Act. In addition to routine testing, DCLS may be called on to respond to various health and environmental emergencies in Virginia. (Web Site: <http://www.dgs.state.va.us/DCLS.index.htm>) Contact: Tom York, 804-692-0512.

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*Continued from Perspective page 1*

keep them away from Steering Committee meetings. Ms. Brown is developing a private consultant practice and Mr. Coffman has accepted a different position with the VRWA. Steering Committee members will greatly miss all three of these people!

The bi-monthly Steering Committee meetings during 2000-2001 also included a variety of informational presentations.

David Nelms of the U.S. Geological Survey spoke about the Virginia Aquifer Susceptibility Study. The Study determines the age of a water source to assess source water's susceptibility to contamination. The study's main objectives are to identify the intrinsic natural susceptibility of regional aquifers in Virginia and to apply susceptibility determinations in the screening of public ground water supplies. Measurements for the study are difficult to assess because old ground water mixes with new. Some of the deepest coastal aquifers studied, which are 30 -40,000 years old, show CFC contamination. Well construction can cause these deeper aquifers to be susceptible. The findings may be summarized in simple terms: any ground water under 50 years old is generally sensitive to contamination, anything older is not. Well depth has little to do with the susceptibility. (Websites with addi-

tional information: [www.water.usgs.gov](http://www.water.usgs.gov); [www.vdh.state.va.us/owp/water\\_supply.htm](http://www.vdh.state.va.us/owp/water_supply.htm))

Terri Brown of the Department of Conservation and Recreation offered a slide presentation concerning source water assessment in karst areas. A demonstration project involved four initial study areas in the karst region of the Shenandoah Valley over the course of two years. The study provided an assessment of the ground water for each locality including availability (i.e. how long a well would potentially be productive), how much water can be taken out without overly depleting the ground water resource, possible contaminants, and the extent of the ground water network. The ground water of the study sites tends not to be under the direct influence of surface water. Results of the study allow the creation of "zones of influence" for the ground water network of a given town, which the locality can use as a guideline for protecting its water supply by land acquisition, zoning ordinances, or other means.

The Steering Committee had a first in the summer of 2001 – a cancelled meeting! Members were disappointed that a jammed core barrel forced cancellation of a planned field trip to the core hole for the Chesapeake Bay Impact Crater study in Mathews County. That field trip likely will be rescheduled sometime during 2001-2002. Steering Committee members can count on another year of informative presentations and discussions concerning the protection of Virginia's ground water resources.

***Spread  
the Word!!!***

Do you know of an individual or organization who would benefit from receiving a copy of this and future Annual Ground Water Reports?

Call Mary Ann Massie  
(804) 698-4042

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# Virginia Natural Resources Leadership Institute

## Graduates First Class

The Virginia Natural Resources Leadership Institute (VNRLI) - VNRLI brings together natural resource leaders and managers from all sectors in Virginia to: (1) develop the leadership skills needed to build consensus around environmental issues, based on the model of “leaders as principled convenors, facilitators, and stakeholders”; (2) build a cross-sector leadership network throughout the state with the capacity to facilitate conflict resolution of natural resource issues; and (3) improve the capacity of Virginia’s communities to engage in productive dialogue and resolution of issues important to community sustainability.

The program represents an innovative partnership effort between the Institute for Environmental Negotiation of the University of Virginia, Virginia Tech, and the Virginia Department of Forestry. It consists of six seminar sessions held over the course of nine months. VNRLI provides a mix of experiential, interactive training and mini-lectures. The experiential training includes exercises based on “real life” environmental issues encountered in Virginia, field trips to better understand the complexities of specific “hot” environmental issues in Virginia, stakeholder panels about current “hot” environmental issues, as well as case studies of both successful and failed efforts at natural resources conflict resolution.

The 2000-2001 class of VNRLI fellows explored environmental issues including:

1) Tobacco and rural community sustainability as illustrated by the

Southern Tobacco Communities Project;

- 2) Water quality and sustainable resource issues as illustrated by the blue crab talks and Tangier Island;
- 3) Growth management and land use legislative efforts, and transportation issues;
- 4) New poultry waste regulations, the Shenandoah Big Gem brownfield



redevelopment site, the Avtex Superfund site in Front Royal, and the Scheaffer International Sewage Plant in Timberville;

- 5) Sustainable forestry, viewshed management, the Forest Bank, Appalachian Sustainable Development, and mined land reclamation;
- 6) Varieties of collaborative processes used to address natural resources issues.

Fellows also explored a range of conflict resolution techniques such as consensus building, principled negotiation, and mediation.

At the end of the program, Fellows cited numerous examples of how the program increased their capacity to address challenges in their communities. In their final evaluations, many described how they felt equipped with sufficient

skills and knowledge to become change-agents for collaborative problem-solving in their communities and organizations.

“Participation in VNRLI has provided me with a deeper awareness and understanding of the complex, inter-disciplinary natural resource challenges facing Virginia,” said one National Park Service staffer. Another Fellow, a Virginia Extension agent, said, “I often find myself in situations that require mediation, negotiation, or facilitation skills. The Virginia Natural Resources Leadership course offers education *and* hands-on experience in all three.”

An unexpected and remarkable outcome of this program was the desire by participants to continue to work together in some capacity on a specific project relating to Virginia’s environment. During the last session Fellows developed a special report for the Commission on the Future of Virginia’s Environment, chaired by Senator Bolling. The report is entitled, “Virginia’s Environment: Issues Envisioned for Virginia’s Environmental Future and Suggestions for Approaches or Processes to Address Issues.” This report will be formally presented to the Commission by VNRLI Fellows.

For more information about the VNRLI Program, contact Tanya Denckla at 434-924-1970, or [td6n@virginia.edu](mailto:td6n@virginia.edu).

The web site is:  
[www.virginia.edu/~envneg/VNRLI\\_home.html](http://www.virginia.edu/~envneg/VNRLI_home.html)

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## VRWA Update

New faces and names are involved in Virginia Rural Water's efforts in Ground Water and Surface Water protection since the last annual report.

Josh Rubenstein is the Groundwater Tech and is charged with taking Ground Water sourced drinking water systems through the steps of creating interest, organizing data, and moving the system into management or action steps to provide protection for their wells or springs.

Josh is currently working with the ongoing efforts in Augusta County as well as beginning a program of protection for the Town of Vinton (Roanoke County). A combined program (VDH-OWP, DEQ, VRWA, and others) has begun to provide planning for the protection of State owned wells. This effort will most likely begin with the Department of Corrections and prisons.

Eric Shortt is the Source Water Tech (NRWA program) and is working with larger geographic areas such as entire watersheds or governmental entities and their combinations to pursue wider scoped plans and protection measures for drinking water quality.

Albert Crigger is also a Source Water Tech (VDH-SWAP State program) and works within and is a part of the Source Water Assessment Program that the Commonwealth is currently implementing. Albert is busy taking the SWAP Assessments as they become available to the localities and developing suitable and specific planning for those systems.

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## Virginia Agriculture Stewardship Act

The *Agricultural Stewardship Act* is the result of a joint effort by Virginia's agricultural and environmental communities, the Association of Soil and Water Conservation Districts and state agencies to develop a commonsense solution to water pollution problems caused by agricultural operations. The goal of the Act is to consider the needs of the farmer while meeting the requirements of the environment.

The Virginia General Assembly passed the law in 1996, and when the *Agricultural Stewardship Program (ASP)* went into effect on April 1, 1997, it represented a very innovative approach to environmental issues.

### ASP Objectives

The program is designed to accomplish these objectives:

- To identify real water quality problems and to help farmers correct them in a commonsense manner that accommodates both the farmer and the environment;
- to establish a system that respects both the farmer and the person voicing concern about water quality;
- to educate farmers about stewardship and to encourage them to enhance it even in instances in which a water quality problem cannot be proven in a legal sense;
- to support farmers in their efforts to strengthen their stewardship practices, to provide them with the information they need, and to help link them to resources that can provide assistance;
- to educate the average citizen about normal farming practices that are not harmful to water quality regardless of their appearance; and
- to provide Soil and Water Conservation Districts with training and the *Agricultural Stewardship Act* materials they need, to the extent that resources will allow.

### How the Program Works

Complaints alleging that a specific agricultural activity is causing or will cause water pollution go to the Commissioner of the Virginia Department of Agriculture and Consumer Services. If a complaint meets the criteria for investigation, the Commissioner's Office contacts the appropriate Soil and Water Conservation District about investigating the problem. If the district declines, the Commissioner's Office conducts the investigation.

The purpose of the investigation is to determine whether the agricultural activity is causing or will cause water pollution. If no causal link is found, the Commissioner will dismiss the complaint. If the investigation determines that the activity is the cause, the farmer is given sixty days to develop a corrective plan. The local District then reviews the plan and when it meets the necessary requirements to solve the water pollution problem, the Commissioner approves it.

From the time the Commissioner determines that a complaint is founded, the Act gives the farmer six months to start implementing his plan and up to eighteen months for full implementation. The timing allows the farmer to take advantage of suitable weather conditions for outside work or construction required. If a farmer fails to implement a plan within the allotted timeframe, the Act requires the Commissioner to take enforcement action.

### Explanation of Complaints

In the fourth year of the *Agricultural Stewardship Program* (April 1, 2000 – March 31, 2001), the Commissioner received more than 100 inquiries regarding possible agricultural pollution, of which 48 became official complaints. The complaints were divided into seven areas: dairy – 23; beef – 6; poultry – 5; cropland – 5; hogs – 4; horses – 3; other – 2.

*Continued on page 12*

### **Percentage of Complaints**

April 1, 2000 – March 31, 2001

- Dairy – 48%
- Beef – 12%
- Poultry – 11%
- Cropland – 11%
- Hogs – 8%
- Horses – 6%
- Other – 4%

The Agricultural Stewardship Act addresses water pollution problems caused by nutrients, sediments and toxins entering state waters from agricultural activities. Twenty-nine of the complaints involved both sediments and nutrients. Thirteen complaints attributed the pollution problems solely to nutrients, while six faulted only sediments. Thirty of these complaints concerned surface water issues, four concerned ground water, and fourteen involved both ground and surface water.

### **Types of Complaints By Percentage**

April 1, 2000 – March 31, 2001

- Sediment and Nutrients – 60%
  - Nutrients – 27%
  - Sediment – 13%

The Commissioner's Office, together with local Districts in many cases, completed investigations in 48 complaints. As of March 31, 2001, four still awaited a decision by the Commissioner, and five had been dismissed.

Investigations determined that 23 of the complaints revealed insufficient or no evidence of water pollution; therefore, these complaints were unfounded. In some of these cases, no clear connection could be made between the alleged pollution and the body of water in question. In other cases, the alleged problem had been corrected by the time the investigation was completed. In some instances, the farmers involved in un-

founded complaints voluntarily incorporated Best Management Practices into their operations to prevent more complaints or to prevent potential problems from developing into founded complaints.

In 17 of the investigations, there was sufficient evidence to support the allegations that the agricultural activities were causing or would cause water pollution. These cases were determined to be founded. Fifteen of the producers with founded complaints submitted plans which were approved by the Commissioner. On March 31, the plans regarding the other two complaints were in the development process.

### **Results of Complaints**

April 1, 2000 – March 31, 2001

- Unfounded - 47%
- Founded - 35 %
- Dismissed – 10%
- Awaiting Decision by Commissioner – 8%

Farmers involved in the complaint and correction process were very cooperative in meeting the deadlines set by the Agricultural Stewardship Act and it was not necessary to assess any civil penalties.

### **Conclusion**

The four years of the Agricultural Stewardship Program provide clear evidence that this approach to water pollution is an effective way to solve a challenging problem. This program recognizes that, although clean water is the goal, there is more than one way to achieve it. Even as each complaint arises from a different set of circumstances, each solution will also be unique.

The Agricultural Stewardship Act relies on the good faith and intentions of those it governs. Farmers care about the land and water resources because their success depends on it. A system created to consider the needs of both the farmer and the environment makes good sense and good environmental policy.

## **New Publications**

Smith, B.S., 2001, *Ground-water flow in the shallow aquifer system at the Naval Weapons Station Yorktown, Virginia*: USGS Water-Resources Investigations Report 00-4077, 33 p.

Plummer, L. N., and other, 2000, *Chemical and isotopic composition of water from springs, wells, and streams in parts of Shenandoah National Park, Virginia, and vicinity, 1995-1999*: USGS Open-File Report 00-373, 70 p.

### **For Ordering Information**

Please check the USGS website at

<http://water.usgs.gov/pandp.html>



Mr. Scott Bruce shows students boxes of core materials from numerous geologic formations.

See **Impact Crater** on page 5

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